

PATENT APPLICATION

METHOD OF APPLYING ADHESIVE

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CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims priority from R.O.C. Patent Application No. 092107441, 5 filed April 1, 2003, the entire disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The invention relates in general to an applying method for an adhesive, and more particularly to an applying method for an adhesive used in micro-fabrication.

10 [0003] Generally speaking, a layer of adhesive, such as hexamethyldisilazane (HMDS), needs to be applied before applying a photoresist on a wafer with a SiO₂ layer formed on the entire wafer surface so that the photoresist can adhere to the SiO₂ layer in a process of photolithography used in micro-fabrication.

15 [0004] With reference to FIG. 1, a diagram of an apparatus used for applying an adhesive to a SiO₂ layer of a wafer is shown. A wafer 100 is placed in a closed container 110 with a supply vent 120, which is connected with a transmission pipeline 130 for conveying an adhesive to the closed container 110. The closed container 110 also includes an exhaust vent or outlet 125, and the exhaust vent 125 is externally connected to a first exhaust pipe 140 and a second exhaust pipe 150. The first exhaust pipe 140 is externally connected to a pump, 20 which can exhaust gas from the closed container 110. The second exhaust pipe 150 is externally connected to a general air-extracting or gas-extracting common pipe, which utilizes the Bernoulli Principle to eliminate the gas in the closed container 110. By using the above-mentioned pump to exhaust the gas from the first exhaust pipe 140 the flow rate is greater than if only the Bernoulli Principle method is used to exhaust the gas from the second 25 exhaust pipe 150.

[0005] Referring to FIG. 1 and FIG. 2 simultaneously, FIG. 2 shows a conventional method for applying an adhesive on a SiO₂ layer of a wafer. The method includes the following steps. First, in step 210, the coating process of applying an adhesive such as HMDS on an oxidation layer of the wafer 100 is begun. In step 220, gas is exhausted from the first exhaust 30 pipe 140 so as to eliminate a part of the gas in the closed container 110. The operation time of this step is approximately five seconds. Next, in step 230, the gas continues to be

exhausted from the first exhaust pipe 140 so as to cause bubbling in the adhesive in the transmission pipeline 130 and convey the bubbled adhesive to the supply vent 120. Operation time of this step is approximately five seconds. In step 240, the gas continues to be exhausted from the second exhaust pipe 150 and ceases to be exhausted from the first 5 exhaust pipe 140. Thus the adhesive reaches a gasification state, and the gasified adhesive is supplied to the closed container 110 from the supply vent 120. The gasified adhesive can then adhere and be coated on the SiO₂ layer. The operation time of this step is approximately forty seconds. Next, in step 250, the gas is exhausted from the first exhaust pipe 140 and ceases to be exhausted from the second exhaust pipe 150, and the remaining gasified 10 adhesive in the closed container 110 is pumped out. The operation time of this step is approximately seven seconds. Finally, in step 260, the coating process of applying the adhesive on the upper oxidation layer of the wafer 100 is accomplished. The method as mentioned above can be applied to such machines as the TEL-MK5Z (produced by Tokyo Electron Limited of Japan) and the like.

15 [0006] In order to coat the photoresist precisely and uniformly on the SiO₂ layer, a method of spin-coating is generally used. In spin-coating, a spinning apparatus drives the wafer 100 to rotate. The photoresist is dropped on the SiO₂ layer and moves toward to the edge of the SiO₂ layer due to the centrifugal force from spinning. In this way, a precisely and uniformly thick layer of the photoresist is eventually formed on the SiO₂ layer.

20 [0007] An objective of applying an adhesive as mentioned above is to have a SiO₂ layer coated with a photoresist in the following micro-fabrication, ensuring the photoresist adheres to the SiO₂ layer tightly. However, due to the influence of the centrifugal force resulting from the rotation of a spinner during the photoresist application process, the binding force of the adhesive is often insufficient, resulting in the photoresist instability and subsequent 25 flaking off the SiO₂ layer. This is the so-called resist lifting issue. Therefore, the conventional applying method for an adhesive results in the photoresist degradation and flaking off the SiO₂ layer very easily.

BRIEF SUMMARY OF THE INVENTION

30 [0008] Embodiments of the present invention are directed to an applying method for an adhesive to ensure the photoresist adheres to a SiO₂ layer tightly without resulting in the

photoresist instability and subsequent flaking off or resist lifting of the SiO₂ layer due to the insufficient binding force.

[0009] The present invention achieves the above-identified objective by providing an applying method for an adhesive on a SiO₂ layer of a wafer in a closed container. The closed 5 container is connected with a transmission pipeline by a supply vent, and the transmission pipeline is used for conveying the adhesive to the closed container. The closed container also includes an exhaust vent which is externally connected with a first exhaust pipe and a second exhaust pipe. The applying method for the adhesive according to one embodiment of the present invention includes the following steps. First, gas is exhausted from the first exhaust 10 pipe so as to eliminate a part of the gas in the closed container. Next, the gas continues to be exhausted from the first exhaust pipe so as to cause bubbling of the adhesive in the transmission pipeline and convey the bubbled adhesive to the supply vent. Later, the gas is exhausted from the second exhaust pipe and continues to be exhausted from the first exhaust pipe so as to greatly increase exhaust of the gas in the closed container and bubbling of the 15 adhesive. Subsequently, the gas continues to be exhausted from the second exhaust pipe and ceases to be exhausted from the first exhaust pipe so as to have the adhesive reach a gasification state. The gasified adhesive is supplied to the closed container from the supply vent and the gasified adhesive can adhere and be coated on the SiO₂ layer. Next, the gas is exhausted from the first exhaust pipe and ceases to be exhausted from the second exhaust 20 pipe, and the remaining gasified adhesive in the closed container is pumped out.

[0010] In another embodiment, a method of applying an adhesive on a wafer comprises placing the wafer in a closed container having a transmission line connected to an inlet of the closed container to supply the adhesive to the closed container, and a first exhaust line and a second exhaust line connected to an outlet of the closed container; bubbling the adhesive in 25 the transmission line by exhausting a portion of gas from the closed container via the first exhaust line; enhancing bubbling of the adhesive in the transmission line by exhausting the gas from the closed container via the second exhaust line and continuing to exhaust the gas from the closed container via the first exhaust line; and gasifying the adhesive in the transmission line and flowing the gasified adhesive into the closed container via the inlet to 30 adhere to and coat the wafer by continuing to exhaust the gas from the closed container via the second exhaust line and ceasing exhausting the gas from the closed container via the first exhaust line.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a simplified diagram of an apparatus used for applying an adhesive on a SiO₂ layer of a wafer.

5 [0012] FIG. 2 is a flow diagram of a conventional method for applying an adhesive on a SiO₂ layer of a wafer.

[0013] FIG. 3 is a flow diagram of the applying method for the adhesive on the SiO₂ layer of the wafer according to an embodiment of the present invention.

10 DETAILED DESCRIPTION OF THE INVENTION

[0014] Embodiments of the present invention are directed to an application method for adhering a photoresist tightly to a SiO₂ layer of a wafer to minimize resist lifting of the SiO₂ layer due to the insufficient binding force.

[0015] Referring to FIG. 1 and FIG. 3 simultaneously, FIG. 3 shows the method for applying an adhesive to a SiO₂ layer of a wafer according to an embodiment of the present invention. Using the same apparatus as the conventional applying method as shown in FIG. 1, the method for the present invention includes the following steps. First, in step 310, the coating process of applying an adhesive such as HMDS on the top of an oxidation layer of the wafer 100 is started. In step 320, gas is exhausted from the first exhaust pipe 140 so as to eliminate a part of the gas in a closed container 110. The operation time of this step typically is approximately five seconds. Next, in step 330, the gas continues to be exhausted from the first exhaust pipe 140 so as to cause bubbling of the adhesive in the transmission pipeline 130 and convey the bubbled adhesive to a supply vent or inlet 120. The operation time of this step typically is approximately five seconds. An objective of this step is not only to cause the adhesive to become bubbled, but also to exhaust the gas from the closed container 110. Later, in step 335, the gas is exhausted from the second exhaust pipe 150 and continues to be exhausted from the first exhaust pipe 140 so as to greatly increase exhaust of the gas in the closed container 110 and increase bubbling of the adhesive. The operation time of this step typically is approximately five seconds. An objective of this step is to approach vacuum conditions in the closed container 110 so that the adhesive becomes more bubbled and will be more precisely and uniformly coated on the SiO₂ layer. In supply step 340, the gas continues to be exhausted from the second exhaust pipe 150 and ceases to be exhausted from the first

exhaust pipe 140 so as to have the adhesive reach a gasification state. The gasified adhesive is supplied to the closed container 110 from the supply vent 120 and the gasified adhesive can adhere to and be coated on the SiO_2 layer. In a reaction time of approximately forty seconds, the adhesive can achieve the optimum state. Next, in step 350, the gas is exhausted from the 5 first exhaust pipe 140 and ceases to be exhausted from the second exhaust pipe 150, and the remaining gasified adhesive in the closed container 110 is pumped out. The operation time of this step typically is approximately seven seconds. Finally, in step 360, the coating process of applying the adhesive on the oxidation layer of the wafer 100 is accomplished. The method as mentioned above can be applied to a machine such as TEL-MK5Z (produced by 10 Tokyo Electron Limited of Japan), and the like.

[0016] The above-mentioned applying method may be used prior to applying the photoresist on the SiO_2 layer. The adhesive ensures the photoresist adheres to the top of the SiO_2 layer. The applying method can be used in a liquid crystal display driver (LCD driver), a power integrated circuit (Power IC), or mask read only memory (Mask ROM), and the like.

15 [0017] It can be seen from the above that the present invention of a applying method for an adhesive can be compared with the conventional method. The present invention adds one more step as step 335 following step 330, which is the same as step 230 in Fig. 2. In addition to increasing the flow rate of gas exhausted from a first exhaust pipe 140 by using an exhaust pump, there is an increased flow rate as a result of the Bernoulli Principle. The gas exhausts 20 externally from a second exhaust pipe 150 by using a general air-extracting or gas-extracting common pipe utilizing the Bernoulli Principle. Thereby, the volume of gas inside the closed container 110 decreases, and barometric pressure becomes much lower, increasing bubbling in the adhesive. On the other hand, by step 335, the extraction of H_2O molecules adsorbed by the SiO_2 layer of the wafer may also occur. Both of these two points that can be achieved in 25 step 335 will improve the adhesion of the adhesive to the SiO_2 layer. As a result, the photoresist will tightly and uniformly adhere with the adhesive to the SiO_2 layer in the wafer rotation process and will not flake off the SiO_2 layer.

30 [0018] The preferred embodiment as disclosed of the applying method for the adhesive according to the present invention will improve a tendency of the photoresist to flake off the SiO_2 layer in the rotation process of the spinner. Therefore, high yield rate of the wafer and low cost can be achieved.

[0019] The above-described arrangements of apparatus and methods are merely illustrative of applications of the principles of this invention and many other embodiments and modifications may be made without departing from the spirit and scope of the invention as defined in the claims. The scope of the invention should, therefore, be determined not with reference to the above description, but instead should be determined with reference to the appended claims along with their full scope of equivalents.